REMARKS / ARGUMENTS

This application is believed to be in condition for allowance because the claims are non-obvious and patentable over the cited references. The following paragraphs provide the justification for this belief. In view of the following reasoning for allowance, the Applicant hereby respectfully requests further examination and reconsideration of the subject patent application.

1.0 Objection to the Specification:

The Office Action dated May 24, 2007 objected to the specification as failing to include support for the term "full rank" as cited in various claims. In particular, the Office Action states that "examiner can not find the term full rank in the specification and is unsure of the meaning associated with the term. What makes them full?"

Applicants respectfully traverse the objection to the specification with respect to the usage of the term "full rank." Specifically, the term "full rank" is a term that is well known to those skilled in the art of conventional linear algebra with respect to the use and evaluation of matrices. If desired by the Examiner, Applicants can provide numerous linear algebra references that describe the concept of full rank with respect to matrices. Further, this concept is typically addressed in most linear algebra text books.

For example, as is well known to those skilled in the art of conventional linear algebra, the ***column*** "rank" of a matrix **A** is the maximal number of linearly independent columns of **A**. Further, the ***row*** rank of matrix **A** is the maximal number of linearly independent rows of **A**. Since the column rank and the row rank are always equal in an *m*-by-*m* matrix, they are simply called the rank of **A**. Similarly, the rank of an *m*-by-*n* matrix is at most the lesser of *m* and *n*. An *m*-by-*n* matrix that has as large a rank as possible is said to have ***full rank***. Further, the use of matrix ***rank*** with respect to the claimed invention is discussed in detail in paragraphs [0095] through [0110] of the specification (see US Patent Application Publication 2005/0010675).

Clearly, the concept of "full rank" is well known to those skilled in the art of linear algebra as simply denoting the largest possible rank for an arbitrary *m*-by-*n* matrix. Further Applicants describe rank computation and evaluation of matrices in paragraphs [0095] through [0110] of the specification. Therefore, Applicants respectfully suggest that the use of the term "full rank" in the claims is fully supported by the use of the term "rank" throughout the specification and by the use of the term "full rank" as a common term of art in the field of linear algebra. In addition, it should also be noted that material in the claims is legally considered to be a part of the disclosure of the claimed invention. As such, Applicants respectfully traverse the objection to the specification and respectfully request withdrawal of the objection to the specification.

2.0 Rejections under 35 U.S.C. §101:

In the Office Action of May 24, 2007, claims 7-9 and 16-18 were rejected under 35 U.S.C. §101 as being directed towards non-statutory subject matter. In response, Applicant has amended independent claims 7 and 16 to address the issues raised by the Office Action.

In particular, with respect to the rejection of independent claim 7, the Office Action suggested that claims "7-9 are directed towards a system without a useful, concrete or tangible result. The claims define a 'system', which is not defined within the claims, and the steps following the preamble are rejected as software per se."

Applicants respectfully suggest that the parameters computed per claim 7, including the combination coefficients, the representation vectors and the decoding matrices, when understood in view of the specification, represent components of a network code for the network topology being evaluated. However, in order to more clearly convey this point, Applicants have amended independent claim 7 to include a limitation for "***constructing a network code*** from the combination coefficients, the representation vectors and the decoding matrices."

Clearly, as is known to those skilled in the art, a network code for a particular network is a useful, tangible and concrete result that has numerous applications with respect to network multicast applications. As such, believes that claim 7, as amended is directed towards statutory subject matter. Consequently, Applicants respectfully request withdrawal of the rejection of claims 7-9 under 35 U.S.C. §101 in view of the amendment to claim 7.

With respect to claims 16-18, the Office Action generally suggests that claim 16 incorporates "... non-statutory subject matter for example signals and carrier waves." However, since the claimed process ***uses a computing device*** which is clearly a physical entity to carry out the claimed process actions, Applicants respectfully suggest that the claimed invention does not include the non-statutory subject matter suggested by the Office Action. However, in order to further prosecution of the present application, Applicants have amended claim 16 to recite the following: "A computer-implemented process, <u>including computer executable instructions stored on a ***physical computer-readable medium***,</u> for computing a network code..." It is believed that this amendment is sufficient to address the rejection of claims 16-18. Consequently, Applicants respectfully request withdrawal of the rejection of claims 16-18 under 35 U.S.C. §101 in view of the amendment to claim 16.

3.0 <u>Rejections under 35 U.S.C. §112:</u>

The Office Action rejected claims 9 and 18 under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement. In particular, the Office Action objected to the use of the term "full rank" in the claims and suggested that the term was not used in the specification. However, as discussed above in Section 1.0, the rank of an m-by-n matrix is at most the lesser of m and n. An m-by-n matrix that has as large a rank as possible is said to have ***full rank***.

Since Applicants discuss rank evaluation of matrices in paragraphs [0095] through [0110] of the specification, the usage of a conventional linear algebra term such as "full rank"

is fully supported when understood in terms of the specification as originally drafted. Therefore, Applicants respectfully traverse the rejection of claims 9 and 18 under 35 U.S.C. §112, first paragraph, and respectfully request withdrawal of the rejection of claims 9 and 18.

4.0 Rejections under 35 U.S.C. §102:

In the Office Action of May 24, 2007, claims 7-9 and 16-18 were rejected under 35 U.S.C. §102(e) as being anticipated by "network Information Flow", IEEE Transactions on Information Theory by R. Ahlswede, et al., hereinafter "***Ahlswede***."

A rejection under 35 U.S.C. §102(e) requires that the Applicant's invention was described in patent granted on an application for patent by another filed in the United States before the invention thereof by the Applicant. To establish that a patent describes the Applicant's invention, *all of the claimed elements of an Applicant's invention must be considered, especially where they are missing from the prior art*. If a claimed element is not taught in the referenced patent, then a rejection under 35 U.S.C. §102(e) is not proper, as the Applicants' invention can be shown to be patentably distinct from the cited reference.

In view of the following discussion, the Applicants will show that one or more elements of the Applicants' claimed invention are missing from the cited art, and that the Applicants' invention is therefore patentable over that cited art.

4.1 Rejection of Claims 7-9:

In general, the Office Action rejected independent claim 7 under 35 U.S.C. §102(e) based on the rationale that the ***Ahlswede*** reference teaches the Applicant's claimed "...system for computing a network code..."

Applicants believe that the Office Action has improperly characterized the capabilities and teachings of the ***Ahlswede*** reference in an attempt to show equivalence to various

elements of the Applicants claimed invention. For example, Applicants respectfully suggest that a careful reading of the entire ***Ahlswede*** reference shows that the teachings provided by the ***Ahlswede*** reference merely demonstrate that if coding is allowed at internal nodes in a network, then the multicast capacity is in general higher than if no such coding is allowed. Further, the ***Ahlswede*** reference also demonstrates the existence of multicast codes that would achieve a natural upper bound on a multicast capacity by applying a max-flow min-cut theorem to the network between a sender and a number of receivers. Unfortunately, unlike the claimed invention, the results offered by the ***Ahlswede*** reference depend on ***random coding arguments*** without providing any construction techniques for practical multicast codes in the manner claimed with respect to the present invention.

As such, Applicants respectfully suggest that the ***Ahlswede*** reference is substantially different from the claimed invention. However, while several of the limitations of the claimed invention are not disclosed or in any way suggested by the ***Ahlswede*** reference, Applicants will focus on one of the claimed limitations in order to specifically address the rejection under 35 U.S.C. §102(e).

For example, the Office Action suggests that the claimed limitation of "computing representation vectors..." is disclosed by the ***Ahlswede*** reference. Specifically, the Office Action offers page 1204 of the ***Ahlswede*** reference and suggests "R is the vector; the symbols are the length of the bits sent."

However, in stark contrast to the position advanced by the Office Action, Applicants respectfully suggest that the claimed "representation vectors" are not disclosed by the "vector R" described on page 1204 of the ***Ahlswede*** reference. For example, the ***Ahlswede*** reference describes the "vector R" as simply the "coding rate" for a particular edge of the multicast network.

In contrast, the "representation vector" claimed by Applicants is specifically defined in paragraphs [0063] to [0065] of the specification. These paragraphs explain that each edge is associated with an *R*-length "representation vector" that shows how the symbol on a particular

edge "is represented in terms of the original source symbols." (See Equations 1-3 and associated discussion in paragraphs [0063] to [0065]). Clearly, the "representation vector" ***defined*** and claimed by the Applicants is not the "coding rate" for a particular edge of the multicast network as disclosed and claimed by the ***Ahlswede*** reference.

Therefore, in view of the preceding discussion, it is clear that the present invention, as claimed by independent claim 7 has elements not disclosed in the ***Ahlswede*** reference. Consequently, the rejection of claim 7 under 35 U.S.C. §102(e) is not proper. Therefore, the Applicants respectfully request reconsideration of the rejection of independent claim 7 and dependent claims 8-9 under 35 U.S.C. §102(e) in view of the language of claim 7. In particular, claim 7 recites the following novel language:

> "A system for computing a network code, comprising:
>
> computing linear combination coefficients for each of at least one interior network node of a network, said nodes including a sender;
>
> ***computing representation vectors for symbols exiting each interior network node from representation vectors for symbols entering each node and the linear combination coefficients***; and
>
> computing decoding matrices for each of at least one receiver of the network from the representation vectors for the symbols entering each receiver; and
>
> constructing a network code from the combination coefficients, the representation vectors and the decoding matrices." (emphasis added)

4.2 Rejection of Claims 16-18:

In general, the Office Action rejected independent claim 16 under 35 U.S.C. §102(e) based on the rationale that the ***Ahlswede*** reference teaches the Applicant's claimed "...computer-implemented process... for computing a network code..." Specifically, the Office Action stated that "Claims 16-19 are substantially similar in scope and claim limitations and are rejected for the same reasons as set forth above.

Therefore, rather than repeat the discussion provided above in Section 4.1, Applicants hereby incorporate that discussion by reference, and will only generally summarize the argument below for purposes of completeness.

In particular, as discussed above, the ***Ahlswede*** reference describes the "vector R" as simply the "coding rate" for a particular edge of the multicast network. The Office Action attempts to equate this vector to the claimed "representation vector."

However, as discussed above, the claimed "representation vector" is specifically defined in paragraphs [0063] to [0065] of the specification. These paragraphs explain that each edge is associated with an *R*-length "representation vector" such that shows how the symbol on a particular edge "is represented in terms of the original source symbols." (See Equations 1-3 and associated discussion in paragraphs [0063] to [0065]). Clearly, the "representation vector" ***defined*** and claimed by the Applicants is not the "coding rate" for a particular edge of the multicast network as disclosed and claimed by the ***Ahlswede*** reference.

Therefore, in view of the preceding discussion, it is clear that the present invention, as claimed by independent claim 16 has elements not disclosed in the ***Ahlswede*** reference. Consequently, the rejection of claim 16 under 35 U.S.C. §102(e) is not proper. Therefore, the Applicants respectfully request reconsideration of the rejection of independent claim 16 and dependent claims 17-18 under 35 U.S.C. §102(e) in view of the language of claim 16. In particular, claim 16 recites the following novel language:

> "A computer-implemented process, including computer executable instructions stored on a physical computer-readable medium, for computing a network code for a network including at least one sender, a plurality of internal nodes and at least one receiver, comprising using a computing device to:
>
> compute linear combination coefficients for each interior network node and the at least one sender;
>
> ***compute representation vectors for symbols exiting each interior network node from representation vectors for symbols entering each***

interior network node and the computed linear combination coefficients; and

compute decoding matrices for each receiver from the representation vectors for the symbols entering each receiver." (emphasis added)

CONCLUSION

In view of the above, it is respectfully submitted that claims 7-9 and 16-18 are in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of claims 7-9 and 16-18 and to pass this application to issue. Additionally, in an effort to further the prosecution of the subject application, the Applicant kindly invites the Examiner to telephone the Applicant's attorney at (805) 278-8855 if the Examiner has any additional questions or concerns.

Respectfully submitted,

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